NUTRITIONAL STATUS OF PATIENTS IN A LONG-STAY HOSPITAL FOR PEOPLE WITH MENTAL HANDICAP

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Objective. To investigate the general nutritional status of patients in Alexandra Hospital, Cape Town, and to determine whether dietary copper deficiency was causing anaemia in hospital patients.

Design. Descriptive and cross-sectional analytical studies.

Setting. A long-stay hospital for people with mental handicap.

Subjects. Information was obtained from the total hospital population. In addition, groups of 15 patients were selected from each of two specific wards, one with active and the other inactive patients. To determine whether copper deficiency was causing anaemia, a sample of 30 patients, divided into three groups (a hypochromic microcytic, a normochromic anaemic and a non-anaemic group) was studied.

Main outcome measures. Body mass indices (BMI) and daily dietary intakes were compared with Recommended Daily Allowance (RDA) values. Serum copper and serum caeruloplasmin levels were used to detect possible copper deficiency.

Results. A considerable number of patients were found to be underweight (32% of males and 26% of females had BMIs < 20). A smaller number were obese (6% of males and 17% of females had BMIs > 30). Poor nutrition was more common in severely handicapped patients and those with acquired causes of their mental handicap. Subjects with Down syndrome were generally well nourished and occasionally obese. Poor dietary intakes of biotin, pantothenic acid, vitamin D and copper were encountered. The serum copper and caeruloplasmin values were found to be within normal limits. Patients with hypochromic, microcytic anaemia had higher serum copper and

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caeruloplasmin levels than those with normochromic anaemia and the control group.

Conclusions. A number of nutritional problems among the inpatient population were found. Many were undernourished, while a smaller number of patients were overweight. In both the active and inactive wards macronutrient intakes were generally within normal limits. However, some micronutrient nutritional deficiencies were encountered. We were unable to establish that dietary copper deficiency was the cause of anaemia in our patients. Elevated serum copper and caeruloplasmin levels found in hypochromic, microcytic patients were thought to result from the existence of low-grade infection, associated with elevation of the acute-phase protein, caeruloplasmin.

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Patients with mental handicap in long-stay hospitals are at increased nutritional risk for a number of reasons.[1] They may suffer from feeding problems resulting from neurological dysfunction, obstructive lesions and from psychological factors that can reduce food intake. There may also be drug/nutrient interactions, or metabolic disorders. In addition, they are usually wholly dependent on the institution for their nutrient intake. Not only is the food selection limited, but budget constraints can also affect the amount of food given. On the other hand, certain conditions such as Prader-Willi and Laurence-Moon-Biedl syndromes, and decreased mobility may lead to obesity.[2,3] It is therefore important to assess the food intake and nutrition indicators of these patients regularly, with staff alerted to symptoms of energy and/or macro- and micronutrient deficiency. Providing quality nutritional care requires an approach designed to meet the needs of many subgroups.[4]

Two collaborative studies on the nutritional status of selected patients at Alexandra Hospital were undertaken by the Department of Psychiatry and the Nutrition and Dietetics Unit of the University of Cape Town to evaluate overall nutritional status as well as to investigate the possibility of copper deficiency. The first study documents the general nutritional status of patients and the second describes the investigation into copper deficiency. The aims of the second study were: (*i*) to determine the extent of anaemia in adult male patients; and (*ii*) to assess the iron status and copper and caeruloplasmin levels of patients. This would enable us to determine whether copper deficiency was contributing to the anaemia.

Background information

Alexandra Hospital maintains a computerised database including date of birth, sex, severity of mental handicap and aetiology of all patients. At the time of the studies the hospital had 615 patients, of whom 313 (51%) were male. The age distribution was < 20 years, 6.3%; 20 - 40 years, 35.3%; 40 - 60 years, 38.4% and over 60 years, 20%. Severity of handicap is categorised as mild, i.e. with an IQ of 50 - 70; moderate 35 - 49; severe 20 - 34 and profound when patients have an IQ of < 20. Two patients were in the mild category, 115 were moderate, 232 severe and 206 were profoundly handicapped. The aetiology of the handicap is classified as prenatal when the cause occurs from the time of conception to the onset of labour, perinatal when it occurs during labour and/or the birth process, or postnatal when it is due to causes after this period. In idiopathic cases there is no obvious cause detectable. Forty per cent were prenatal, 14% were acquired during the perinatal or postnatal periods and the remaining 46% were idiopathic.

Methods

Assessment of general nutritional status

All patients in the hospital are routinely weighed and measured and a BMI is calculated by dividing the weight in kilograms by the height in m^2. In addition to this, a sample of 30 patients was selected for evaluation of nutrient intake. The sample comprised two groups of 15 patients each, chosen from two specific wards, one including active and the other inactive patients. The patients were weighed using a Philips digital scale and measured with a stadiometer on the same day. The dietary intake of the 30 patients was assessed over 7 consecutive days. The patients received four meals a day and researchers were present to monitor all meals. The following method of intake assessment was used: an average of 10 measurements was used to calculate the capacity of all the crockery, i.e. metal plates, metal bowls, plastic bowls, plastic mugs, etc.; all plate wastages were weighed and recorded for each individual patient and subtracted from the exact amount allocated to give an accurate measurement of the individual food intake; patients were observed at all meal times to ensure that no stealing of food took place; the information was analysed by means of the Foodfinder Computer Programme to give exact amounts of nutrients, vitamins and minerals consumed. Daily intakes were compared with the RDA values[5] for the particular gender and age group. These reflect values judged to be satisfactory for meeting the nutritional needs of most healthy population groups and are not intended to indicate individual needs or the needs of those with specific requirements. Two-thirds of the RDA is usually regarded as adequate. All data were entered and analysed using the Epi-Info programme.

Evaluation of anaemia with special reference to possible copper deficiency

To determine the extent of anaemia in adult male patients, a fingerprick haemoglobin examination was done on a random

sample of 105 adult male patients drawn from the Alexandra Hospital patient population. Full blood counts were carrried out on all subjects with a reading of < 13 g/100 ml, and these were then compared with normal values. Weight and height of all patients were measured and BMIs calculated.

On the basis of these results the 10 patients who were found to be anaemic were divided into two groups, namely hypochromic/microcytic (8) and normochromic anaemic (2). These newly diagnosed anaemic patients were added to the group of 10 patients in Alexandra Hospital who had been diagnosed over the past 3 months as having either hypochromic/microcytic or normochromic anaemia. The rationale for this inclusion was that any treatment introduced during the past 3 months to address the anaemia would not have affected the copper status.

Because of the possible effects on copper and caeruloplasmin levels, a number of exclusion criteria were applied, namely: (*i*) women on oral contraception; (*ii*) patients with obvious acute or chronic infections; (*iii*) patients with liver disease; (*iv*) patients with Wilson's disease; and (*v*) patients with Menke's disease.

The final sample size of 30 included 10 controls and was designated as follows: group I: 8 microcytic, hypochromic anaemic patients; group II: 12 normocytic normochromic anaemic patients; and group III: 10 normocytic, normochromic controls.

Venous blood was drawn for serum copper levels and blood was inserted into a gel and clot activator tube for estimation of caeruloplasmin levels by the Department of Chemical Pathology at the Groote Schuur Hospital.

RESULTS

General nutritional status

The distribution of BMIs for the total hospital population is given in Table I according to gender. Males had significantly lower BMIs than females (chi-square (χ^2) = 24.3, df = 3, $P < 0.00$). There was a significant relationship between age and BMI, with the younger patients lighter for their heights ($\chi^2 = 20.5$, df = 9, $P < 0.01$). Degree of handicap was strongly related to BMI, with the more severely handicapped generally poorly nourished ($\chi^2 = 59.9$, df = 3, $P < 0.00$). As regards aetiology of handicap, the congenital cases were better nourished than the acquired ($\chi^2 = 12.0$, df = 3, $P < 0.01$), as were idiopathic cases ($\chi^2 = 16.0$, df = 3, $P < 0.00$). There was no significant difference between congenital and idiopathic groups. The 80 people with Down syndrome, who comprised a subset of the congenital group, were heavier than the other patients ($\chi^2 = 10.2$, df = 3, $P < 0.02$).

The average daily intake of macronutrients and BMIs of the 30 patients, divided into active and inactive groups, are given in Table II. The mean BMI for the active group was 21.4 kg/m^2, and for the inactive group 22.12 kg/m^2. The patients in the active ward received significantly more macronutrients than those in the inactive ward, although their BMIs were similar. Although the stated intake of protein (Table II) appears to be adequate, this represents an unacceptably high intake of poor

Table I. Distribution of body mass index (BMI) in male and female patients

	Males		Females	
	BMI	%	BMI	%
Underweight	< 20	32	< 20	26
Acceptable weight	> 20 < 25	43	> 20 < 25	33
Overweight	> 25 < 30	19	> 25 < 30	24
Obese	> 30	6	> 30	17

Table II. Average daily intake of macronutrients

	Active patients		Inactive patients	
	Mean	%RDA	Mean	%RDA
Energy (kJ)	10 576	82	8 646	71
Total protein (g)	95.4	151	88.4	71
Total fat (g)	85.1	84	69.5	72.3
Saturated fat (g)	27.4	81	24.4	76.1
MUFA (g)	33.5	99	26.8	83.6
PUFA (g)	15.6	46	11.6	36.1
Cholesterol (mg)	284	95	264	87.8
Total CHO (g)	34.4	83	270	68.7
Fibre (g)	38.5	128	28.5	95.1
Added sugar (g)	50.2	121	40.8	104
Total CHO-sugar (g)	294.3		229.9	

MUFA = monounsaturated fatty acid; PUFA = polyunsaturated fatty acid; CHO = carbohydrate.

Table III. Average daily intake of vitamins

	Active patients		Inactive patients	
	Mean	%RDA	Mean	%RDA
Vitamin A	1 962	196	1 832	183
Thiamine (mg)	1.69	113	1.26	84
Riboflavin (mg)	1.72	101	1.5	88
Niacin (mg)	26.6	140	21.2	111
Pyridoxin (mg)	2.02	101	1.68	84
Folic acid (µg)	367	184	275	138
Vitamin B_{12} (µg)	4.15	207	4.51	225
Vitamin C (mg)	224	377	177	295
Pantothenic acid (mg)	4.1	75	3.8	69
Biotin (µg)	26.5	41	22.2	34
Vitamin D (µg)	4.66	93	3.15	63
Vitamin E (mg)	10.1	101	7.88	79

quality protein (bread and cereal served with water and not milk). The average daily mineral and vitamin intakes are presented in Tables III and IV. Although the active patients generally received better intakes than the inactive patients, most values were well above the recommended daily averages. Exceptions were biotin for both groups, vitamin D for the inactive group and copper for both groups.

Table IV. Average daily mineral and trace element intake

	Active patients		Inactive patients	
	Mean	%RDA	Mean	%RDA
Calcium (mg)	69.3	89	70.9	89
Phosphorus (mg)	1 483	185	1 368	171
Magnesium (mg)	474	135	399	114
Iron (mg)	17.2	172	12.1	121
Zinc (mg)	14.5	97	13.2	88
Copper (mg)	1.71	78	1.37	62

Haematological results

Haematological results of the two anaemic groups and the control group are given in Table V. In the hypochromic, microcytic group the values were as follows: serum iron — mean 5.46 µmol/l (standard deviation (SD) 2.84); total iron-binding capacity (TIBC) — mean 62.83 µmol/l (SD 14.31); % saturation — mean 9.87 (SD 7.06); and serum ferritin — mean 18.59 µg/l (SD 11.78). Serum copper values for the three groups are given in Table VI.

Discussion

The male patients had lower BMIs than the females. There were more males in the underweight category and fewer males were overweight. These findings are consistent with those of Cunningham *et al.*,[6] who studied a random sample of 1 000 institutionalised patients in Dublin. However, when their BMIs were compared with ours, more of our male patients were underweight (32% compared with 19%). Our female patients were more likely to be both underweight (15% compared with 5%) and overweight (23% compared with 15%). In both the active and inactive wards, the macronutrient intakes for the patients were within the normal range (> 75% of the RDA), except for the ratio of fatty acid composition of the total fat. The kilojoule intake was significantly different between the wards. The difference was attributed to snacks, which were only offered to the active patients. The total energy intakes were low and well below the recommended level for the active group. The food portions appeared to be very small in both wards, with intake reduced further because of plate wastage in the inactive ward and apparent leakage between kitchen and

Table V. Haematological values for anaemic groups

	Hypochromic, microcytic anaemia (N = 18) (mean (SD))	Normochromic anaemia (N = 12) (mean (SD))
Red blood cells (10^{12}/l)	4.11 (0.84)	4.01 (0.61)
Haematocrit (1/1)	0.32 (0.1)	0.37 (0.05)
Mean corpuscular volume (fl)	71.4 (9.75)	90.3 (7.76)*
Mean cell haemoglobin (pg)	20.7 (4.49)	29.25 (3.05)*
Mean cell haemoglobin concentration (g/dl)	28.6 (2.68)	32.5 (1.93)*
Red cell distribution width (%)	19.1 (2.42)	14.4 (2.58)†
Haemoglobin (g/dl)	9.25 (2.32)	11.4 (0.9)

*$P < 0.00$.
†$P < 0.01$.

Table VI. Serum copper and caeruloplasmin values

	Hypochromic, microcytic anaemia (N = 8) (mean (SD))	Normochromic anaemia (N = 12) (mean (SD))	Control group (N = 10) (mean (SD))
Serum copper (µmol/l)	24 (3.02)	18.9 (3.58)	20 (4.34)*
Serum caeruloplasmin (g/l)	0.44 (0.07)	0.31 (0.07)	0.34 (0.07)†

* $P < 0.05$ for hypochromic/microcytic anaemia and normochromic anaemia and hypochromic/microcytic anaemia and control group.
† $P < 0.05$ for hypochromic/microcytic anaemia and normochromic anaemia and hypochromic/microcytic anaemia and control group.

patients. Several items that appeared on the menus, e.g. cold meat for supper, were not served to patients. The inactive ward patients appeared to be satisfied after their meals, but this was not the case in the active ward.

The vitamin D intake in the inactive ward was below accepted levels. The reason for this is not obvious, but as long as the patients spend some time in the sun every day, there is no major cause for concern.[7] Because of the difficulty in determining the specific requirements of certain micro-elements, a range of recommended intakes is sometimes given as the estimated safe and adequate daily dietary intake (ESADDI). In this study three of these nutrients were of some concern, namely the vitamins biotin and pantothenic acid and the trace element copper (Table VII). Theoretically, a biotin deficiency may result in scaly desquamation, lassitude, hair loss, depression, anorexia and glossitis.[8] Because of the difficulty in communication with the patients, the symptoms may be difficult to detect. On the other hand, given the high potency of biotin and the fact that a considerable amount is synthesised by intestinal bacteria and absorbed by the body, symptoms of deficiency are highly unlikely. Pantothenic acid ingestion during the period of study was also low. A deficiency can result in mental depression, fatigue and lowered resistance to infection, but as with biotin, the symptoms would be difficult to detect. However, overt pantothenic acid deficiency is not encountered in practice owing to the widespread presence of this vitamin in a variety of foods.[8]

Table VII. Intake of biotin, pantothenic acid and copper in relation to estimated safe and adequate daily dietary intake (ESADDI)

	ESADDI	Active patients	Inactive patients
Biotin (µg)	30 - 100	26.5	22.2
Pantothenic acid (mg)	4 - 7	4.1	3.8
Copper (mg)	1.5 - 3	1.7	1.4

The calcium intake for both wards was between 85% and 95% of the RDA. This does not constitute a deficiency, but because anticonvulsant drugs can result in disorders of vitamin D, mineral and bone metabolism,[9] this aspect should be monitored. The dietary copper intake of the patients in Alexandra Hospital appeared to be inadequate. Copper deficiency can result in a decrease in serum copper and could lead to a microcytic, hypochromic anaemia. In contrast, the intake of dietary iron was high. The question of copper deficiency and possible anaemia indicated the need for further investigation.

Despite an adequate intake of iron, anaemia remains a problem in this institution. Reasons that may explain the normal levels of copper include the possibility that serum copper may not be a valid measure of copper status.[2] The test of the activity in the red blood cells of the copper-dependent enzyme superoxide dismutase may be more appropriate.[3] Secondly, individuals in the microcytic, hypochromic group were found to have higher serum copper and caeruloplasmin levels. This can be explained by the possible existence of a low-grade infection in the anaemic group, resulting in elevated levels of the acute-phase protein caeruloplasmin.

Conclusion

The present study found a considerable number of patients to be underweight. A smaller number were found to be obese, with males generally less well nourished than females. Poor nutrition was more common in severely handicapped patients and in those with acquired causes of mental handicap. People with Down syndrome were generally well nourished and occasionally obese. Poor dietary intakes of biotin, pantothenic acid, vitamin D and copper were encountered. Although dietary copper deficiency was found, this did not result in reduced serum levels, nor was it associated with anaemia. In conclusion, because mentally handicapped patients are at nutritional risk, they should be assessed regularly and any dietary deficits remedied. This is particularly important given the severe financial constaints of many hospital budgets.

Practical recommendations

1. Strict control should be consistently implemented to ensure that all menu items reach the patients, and where necessary ongoing assistance should be given to those with inadequate feeding skills.

2. A portion of organ meat should be served weekly. Organ meats are important sources of copper, biotin and pantothenic acid as well as a variety of other essential nutrients. Liver and kidney are also inexpensive.

3. Larger portion sizes should be available for patients who are active and clearly dissatisfied with limited amounts served.

4. The proportion of protein in the diet should be increased by giving adequate portions of high-protein foods.

For the underweight group, the measures listed below may be appropriate:

1. Fat intake could be increased by adding margarine/butter/oil to the food; it will contribute 45 kcal per teaspoonful of oil added to vegetables, porridge or rice. Food can be fried instead of baked or grilled. Full-fat dairy products should be used. Other useful sources of fats include all nuts, peanut butter, avocado pear, salad dressing, mayonnaise, and chocolate.

2. Nutritional supplements or milk powder offered in the

form of milkshake-type drinks are useful. Ensure or Build Up are easy to mix in water or milk and would provide additional micronutrients as well.

3. If finances allow, dried fruit or fruit juices can be used to provide additional between-meal calories.

4. Additional sugar can be added to tea, coffee and milk drinks.

5. Milk drinks such as Milo and hot chocolate can be included as an evening snack.

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